

Economic Impact: Methodology and Overall Findings

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ABSTRACT

This paper summarizes five phases of a comprehensive Economic Impact Study conducted by the North Carolina School of Science and Mathematics (NCSSM) from 2009-2011. The methodology and assumptions of those analyses is summarized for those wishing to conduct similar studies. The paper also documents highlighted results, such as the school's estimated \$521 million in 2009 contributions to the North Carolina economy, including over

\$20 million in institutional spending, \$1.1 million in state taxes, and nearly \$500 million in economic activity by NCSSM alumni. Over their lifetimes, each cohort of NCSSM graduates who reside in North Carolina contributes between \$48.4 and \$66.8 million in taxes to the state's treasury. As the publicly-supported school continues to expand enrollment, its economic impact on the region will continue to grow.

In 2009-11, the North Carolina School of Science and Mathematics conducted several phases of a comprehensive Economic Impact Study. The following paper describes the overall results of the study and provides a detailed overview of the methodology.

INTRODUCTION

The North Carolina School of Science and Mathematics (NCSSM)

As the nation prepared to enter the 1960s space race, North Carolina governor Terry Sanford envisioned developing a school to nurture the state's scientific talent. In 1980, with increased international competition in scientific and technological innovation, Governor James B. Hunt, along with former Sanford administration official John Ehle, and NC State Senator Kenneth C. Royall worked with the state's legislature and business community to establish the North Carolina School

of Science and Mathematics, the nation's first publicly-funded residential high school for students gifted in science and mathematics.

The legislation establishing the school mandated that NCSSM: (1) train North Carolina's future scientists, engineers, and mathematicians at the school's Durham campus; and (2) provide outreach to cultivate and nurture K12 scientific talent throughout the state.

In admitting the state's most promising high school juniors and seniors, the school was required to draw equal representation from among North Carolina's 13 Congressional Districts.

The school's first class graduated in 1982, and approximately 7,500 graduates representing all 100 counties of North Carolina have passed through NCSSM's doors. In 2005, the school became the 17th constituent campus of the University of North Carolina system.

Today 680 students live and learn on the 27-acre Durham campus, situated on the grounds of the former Watts Hospital. Approximately 80 faculty members provide rigorous instruction in the humanities, mathematics, and sciences. Eighteen specialized schools throughout the world have been founded on NCSSM's model, and NCSSM helped to found the National Consortium of Specialized Secondary Schools of Mathematics, Science, and Technology (NCSSSMST), which now counts over 100 members nationwide.

A Multi-Phased Approach to the NCSSM Economic Impact Study

With governments across the country seeking to understand the impact of their expenditures, the North Carolina School of Science and Mathematics conducted a series of related studies to understand the return on taxpayer investment in the school and its graduates. The NCSSM Economic Impact Study was built upon several foundational analyses, which are described briefly below.

Alumni Survey Each fall, the North Carolina School of Science and Mathematics conducts a detailed annual survey of its various alumni classes. Information collected includes data regarding their post-secondary education, career path, and continued involvement in the Science, Technology, Engineering, and Math (STEM)



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fields. Prior to 2009, only reunion classes and recent graduates who'd completed their first year of college were surveyed. With the 2009 survey, all alumni were able to access the survey on the alumni website and through alumni communications.

Tuition Waiver Analysis In December, 2009, NCSSM worked with a Board of Trustees member to examine the return on the state's investment in a tuition waiver program with the University of North Carolina (UNC) system. For the NCSSM classes graduating from 2004 to 2010, the state of North Carolina waived tuition fees for any NCSSM graduate enrolling in one of the other 16 UNC campuses. Due to state budget shortfalls, the NC legislature ended the program with the graduating class of 2010.

NCSSM Economic and Social Impact Survey In March-April, 2010, the school conducted a special survey of its graduates to understand the deeper economic and social impact of their contributions to the state of North Carolina. Its findings were published in an internal white paper.

North Carolina High School Graduates Survey In May, 2010, under the leadership of an NCSSM Foundation Board member, a research team of UNC Kenan-Flagler Business School (KFBS) students conducted a random telephone survey of 226 North Carolina high school graduates to provide a context for the NCSSM Economic and Social Impact Survey. The KFBS team combined the findings from the NCSSM Economic and Social Impact Survey and from the NC high school graduates into an Economic Impact Study.

IMPLAN Analysis A professor at Western Carolina University, whose child attended NCSSM, conducted a separate study of the NCSSM Economic Impact on the local region, excluding alumni metrics. The study included an estimate of the expected economic impact of the proposed construction of the school's Discovery Center.

Highlights Of Overall Findings

The North Carolina School of Science and Mathematics provides an enormous boost to the local, state, and national economies. All told, in 2009, the latest year for which complete data is available, the school's employees, students, and graduates pumped approximately \$521 million into the North Carolina economy.

The school's original mission to cultivate and retain the best of North Carolina's STEM talent for the benefit of the state has been soundly successful by any number of measures:

Driving the Economy

The North Carolina School of Science and Mathematics spending contributes nearly \$22 million to the North Carolina economy, including \$1.1 million in taxes. Spending in 2008-09 by NCSSM and its 220 employees and 650 students created or maintained 154 additional jobs. As the school continues to expand enrollment, its economic impact on the region will continue to grow. NCSSM alumni residing in North Carolina pump nearly \$500 million into the state's economy annually.

Over their lifetimes, each cohort of NCSSM graduates who reside in North Carolina contributes between

\$48.4 and \$66.8 million in taxes to the state's treasury. This figure does not include additional revenues accruing from the thousands of part-time NCSSM students whose advanced preparation through NCSSM's Distance Education program resulted in increased lifetime earnings.

At least forty-five NCSSM alumni hold patents and 104 own companies, including five companies that employ over 500 people.

Over 20% of alumni report household incomes of \$100,000-150,000, with another 14.6% reporting household incomes over \$200,000.

Other Impacts to North Carolina, the US, and the World

On a larger scale, NCSSM graduates contribute integrally to the advantages that science and technology confer on the general living standards of the United States.

According to President Obama's STEM Commission report issued in September, 2010, "Since the beginning of the 20th century, average per capita income in the United States has grown more than sevenfold, and science and technology account for more than half of this growth.

In the 21st century, the country's need for a world-leading STEM workforce and a scientifically, mathematically, and technology literate populace has become even greater, and will continue to grow—Particularly as other nations continue to make rapid advances in science and technology." (President's Council of Advisors on Science and Technology, 2010).

As a public institution, the school's impact can be measured in non-monetary terms as well. Many of the investments made in NCSSM students are returned to the people served by NCSSM graduates within their pro-

fessional careers, over one-fourth of which are in education or medicine.

Commitment to STEM

As an incubator of the state's most promising STEM talent, NCSSM appears to encourage a greater share of its brightest students to pursue STEM degrees than that share among other schools with academically-motivated students. Among the top quintile of all US high school graduates, 13.8% pursue STEM degrees, while just above 50% of NCSSM alumni receive a degree in the STEM fields, or over 3X as many (Lowell, Salzman, Bernstein, & Henderson, 2009). Among all college students, only 10.7% majored in STEM in the 2008-09 academic year, roughly 1/5 the rate at which NCSSM graduates study STEM (National Center for Education Statistics, 2011).

Half of NCSSM graduates hold a master's degree, and 25% a doctorate.

Over 13% of alumni are employed in the medical field, and more than 500 care for patients in North Carolina's top 10 hospitals.

Commitment to North Carolina

Ties to North Carolina run deep. Nearly 60% of NCSSM alumni still reside in North Carolina and nearly 35% work in North Carolina organizations. Of those NCSSM alumni who live out of state, 92% visit North Carolina annually.

Commitment to Education

Annual alumni surveys consistently show an interest and commitment to education at the elementary, secondary, and post-secondary levels. Nearly 14% of all alumni, the largest share, are currently employed in education.

One fourth of all NCSSM alumni teach at some point in their careers; in fact, currently, alumni teach at 15 of the state's largest universities. Nearly

40% of NCSSM graduates who teach provide education in the STEM fields.

Commitment to Service

Nearly 64% of alumni volunteer for community or social organizations on a weekly basis. By contrast, 39.7% of North Carolina residents volunteer weekly.

NCSSM Outreach

NCSSM's dual mandate to provide STEM education to teachers and students from across the state has reaped tremendous benefits. Students in rural parts of the state who could not access advanced courses are served by NCSSM's Distance Education and Extended Programs Division, and North Carolina's teachers receive intensive professional development training.

Such STEM outreach provides economic benefits to the state as well. A 2004 study in the Review of Economics and Statistics suggests that advanced math classes in high school can increase a student's future earnings by between 3.1% and 6.5% (Rose and Betts, 2004). As with the NCSSM residential students, increasing the earning power of North Carolina's future workers across the state translates into higher tax revenues for North Carolina.

Over its history, NCSSM outreach programming has provided professional development to more than 4,000 North Carolina teachers, primarily in the subjects of science and mathematics.

As the largest provider of K12 outreach programs to North Carolina, NCSSM offers honors and Advanced Placement credit courses to more than 500 part-time students from 30 North Carolina schools.

NCSSM's online program, which awarded its first certificates of comple-

tion in 2009, offers over 15 honors and Advanced Placement courses to over 180 students annually. An additional 2,500 students at over 50 schools receive high quality enrichment programming annually.

Each summer, over 400 students and educators come to the Durham campus for educational programs and professional development.

METHODOLOGY

Alumni Surveys

NCSSM annually prepares two surveys for its alumni: first, a survey of approximately 20 questions for its graduates who've just completed their first year of college ("One Year Out" survey); and second, a survey of approximately 34 questions for older alumni. Special appeals go out to NCSSM graduates celebrating their 5th, 10th, 15th, 20th, 25th, and soon, 30th reunions to complete the survey.

The surveys are distributed via an electronic link to alumni's email addresses. A second HTML link is posted and available at the alumni website. Several gentle email and e-newsletter reminders leading up to reunions encourage alumni to complete the survey. The survey is constructed so that, upon completion and submission, the respondent is automatically routed to the NCSSM Alumni webpage.

Over the last three years, NCSSM has streamlined the survey in order to make the most effective use of respondents' time. The balance between the school's desire for as much useful information as possible and the need not to overwhelm or alienate the respondent is constantly weighed. Questions with more measurable, actionable outcomes have replaced others that did not provide information upon which NCSSM could act to improve the ex-

periences of students or alumni.

Over the last three years, on average, 65 of the approximately 320 members of the NCSSM graduating class (20%) that has completed its first year of college responded to the "One Year Out" survey. Over that same time period, an average of 133 reunion alumni annually have completed the "Older Alumni" surveys. In 2009 and 2010, an additional 147 and 92 older non-reunion alumni completed the "Older Alumni" surveys, respectively.

Tuition Waiver Analysis

In December, 2009, an NCSSM Board of Trustees member, Henry Kuo, worked with NCSSM to measure the economic impact to North Carolina of the NCSSM-UNC tuition waiver.

Implemented in 2004, the tuition waiver aimed to increase the percentage of NCSSM graduates attending University of North Carolina institutions. The goal of the waiver program was to increase the likelihood of students with specialized skills remaining in North Carolina and contributing to the North Carolina economy. Prior to the grant, approximately 58% of NCSSM graduates enrolled in the state's public university system. With the tuition waiver, an average of 80% of NCSSM graduates attended UNC schools.

The Tuition Waiver Analysis estimated the revenues returned to North Carolina's treasury through the taxable earnings of NCSSM graduates who remain in North Carolina. The revenues gained from retaining additional NCSSM graduates in North Carolina through the tuition waiver were compared to the costs of educating NCSSM students at NCSSM and with the tuition waiver. The study suggested that, for a \$3.7 million investment in the UNC tuitions of each

NCSSM graduating class, the state receives an additional \$18.3 million over the \$48 million already collected from NCSSM alumni in yearly taxes.

To estimate lifetime incomes, the analysis utilized federal government estimates of the average income of 2009 college graduates as well as the average annual income increase for bachelor's degree holders. The assumptions are conservatively calculated; according to the Bureau of Labor Statistics, STEM degree holders generally enjoy higher lifetime earnings (U.S. Bureau of Labor Statistics, 2007). The study assumed a 40-year working/taxpaying life.

The two largest UNC campuses, UNC-Chapel Hill and North Carolina State University, provided their estimates of the share of their graduates remaining in North Carolina. Estimates of the state's weighted average tax rate aided in the calculation of revenues accruing to North Carolina.

NCSSM Economic and Social Impact Survey

In March-April, 2010, 1,012 alumni responded to the school's special Economic and Social Impact Survey. The survey was distributed in the same manner as the NCSSM alumni surveys. The 10-question survey included queries about volunteering, income, and, for those who hadn't responded to the alumni survey, company ownership and patents.

North Carolina High School Graduates Survey

In spring, 2010, under the leadership of NCSSM Foundation Board Member Randy Myer, a professor at UNC-Chapel Hill's Kenan-Flagler Business School (KFBS), MBA students conducted a telephone survey of 226 North Carolina residents who had, at a minimum, graduated high

school. They compared their data to that compiled in the NCSSM Alumni and Economic Impact Surveys. Ideally, the KFBS survey would have captured graduates of top high schools in North Carolina, but the results argue persuasively for the value of the NCSSM degree.

The KFBS survey showed that the household incomes of North Carolina residents who had not attended NCSSM were about half those of NCSSM graduates living in North Carolina. NCSSM graduates had much higher levels of academic achievement as measured by post-secondary degrees, and were significantly more likely to be employed in the teaching profession and to volunteer their time to community organizations.

IMPLAN Analysis

To calculate direct and indirect economic impacts resulting from the operation of the NCSSM facility, Western Carolina University professor, Dr. Inhyuck “Steve” Ha, utilized the IMPLAN (IMpact Analysis for PLANning) software to construct a model of economic impact. The software calculates the direct and “ripple effect” of NCSSM spending within the local and regional economies.

Using the inputs of 2008-09 NCSSM data regarding wages paid and goods and services purchased, the IMPLAN model estimated the Direct Dollar impacts (wages and supplies) and multiplier effects based on the type of direct expenditures.

For example, one type of multiplier effect estimated are Indirect Dollars, dollars spent on goods or services to replenish or improve Direct Dollar purchases. Another type of multiplier effect is Induced Dollar spending, or that spending from increased household wages that resulted from

increased spending on Direct or Indirect goods or services.

The IMPLAN analysis suggested that NCSSM’s 2009 direct impact on the North Carolina economy was \$15.7 million, with indirect impacts of nearly \$3 million and induced impacts of \$2.8 million, for a total effect of \$22 million. Further, purchases by NCSSM employees and students generated or maintained another 154 jobs in the state. As the school increases enrollment, the direct, indirect, and induced impacts on North Carolina’s economy will continue to increase.

Expansion of the school’s physical campus will also provide a tremendous boost to the North Carolina economy. The Discovery Center, now in its planning stages, would renovate and expand the current facilities and add residential, classroom, and outdoor space. Campus square footage would be increased by half. The construction of the Discovery Center would increase the impact seven-fold, to \$154 million. The facility’s expansion would create more than 1,000 new jobs annually during the construction phase.

Resulting Economic Impact Statements

Brock Winslow, NCSSM Vice Chancellor for Institutional Advancement, Randy Myer, Entrepreneurship Professor of the Practice, UNC Kenan-Fla-

gler Business School, and members of the NCSSM communications team including Lauren Everhart, Aaron Plourde, and Joyce Ventimiglia, aggregated elements of the aforementioned studies and surveys into different communication vehicles, which are distributed widely.

CONCLUSION

As all publicly-funded institutions become increasingly subject to concerns about the effective use of taxpayer dollars, a comprehensive Economic Impact Statement can highlight the enormous return on investment — both in monetary and non-monetary terms — that a specialized secondary school provides its state’s economy. In developing such a statement, it is imperative that schools broadly consider their impact on numerous constituencies not ordinarily served by other schools or institutions.

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